VPAC

User's Manual

Solid State Relay
Power Control

WATLOW
Watlow Controls
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General Description

The VPAC Series Power Controls are a family of Solid State Relay (SSR) controls for electric heating applications. The VPAC provides output power proportional to the input command signal from a temperature control. The single phase VPAC-01 can be ordered in either ON/OFF (solid state contactor), burst fired or phase angle firing mode. The three phase, two leg VPAC-32 is for solid state contactor or burst fired (loop powered) operation only.

Model Number (1821)

VPAC Series V ___ - ___ - ___ - ___

Phase
01 = Single Phase
32 = Three Phase, Two Leg, Burst fired (BL) or SS contactor (CA, CD) only.

Voltage
12 = 120V~(ac)
24 = 240V~(ac)
27 = 277V~(ac)
38 = 380V~(ac)
41 = 415V~(ac)
48 = 480V~(ac) (in 25A and up only)

Current
10 = 10Amps
25 = 25Amps
40 = 40Amps
50 = 50Amps
75 = 75Amps

Control Mode
BL0 = Burst fired, variable time base, loop powered, 4-20mA input-08-5399
*BT1 = Zero cross, variable time base, transformer powered. Single phase only, 4-20mA input calibration.
*BT2 = Zero cross, variable time base, transformer powered. Single phase only. 0 to 5VDC input calibration. Can be used for manual potentiometer input.
*AT1 = Phase angle, transformer powered. Single phase only. 4-20mA input calibration.
*AT2 = Phase angle, transformer powered. Single phase only. 0 to 5VDC input calibration. Can be used for manual potentiometer input.
CA0 = Contactor, AC Input
CD0 = Contactor, DC Input

***Transformer included for AT+ and BT.**

Accessory

08-5362 = Manual Control Kit, 1K Potentiometer
(08-5362 for use with AT+ and BT Cards only)

Semiconductor Fuses for VPAC Through 75 Amps

	Amp Rating	Voltage Rating	Bussmann P/N	Watlow Fuse P/N	Watlow Fuse Holder P/N
VPAC SCRs and SSRs					
10 amp	12	600	FWC12A10F	17-8012	17-5110
25 amp	32	600	FWC32A10F	17-8032	17-5110
40 amp	50	700	FWP50A14F	17-8050	17-5114
50 amp	63	700	FWP63A22F	17-8063	17-5122
75 amp	100	500	FWP100A22F	17-8100	17-5122

Warranty

The VPAC is warranted to be free of defects in material and workmanship for 36 months after delivery to the first purchaser for use, providing that the units have not been misapplied. Since Watlow has no control over their use, and sometimes misuse, we cannot guarantee against failure. Watlow's obligations hereunder, at Watlow's option, are limited to replacement, repair or refund of purchase price, and parts which upon examination prove to be defective within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse, abuse, or improper fusing.

Specifications (1822)

Solid State Relay Power Control with Heat Sink
- Solid state contactor, AC input (CA)
- Solid state contactor, DC input (CD)

Optional Loop-Powered Control Card
- Burst firing (zero cross) control, 4-20mA (BL)

Optional Transformer-Powered Control Card
- Burst firing (zero cross) control, Process Input, 1Ø only (BT)
- Phase angle control, Process input, 1Ø only (AT+)
- SDA Shorted SSR Alarm (for Zero cross only)

Line Voltage (50/60Hz)
- 120V~(ac) operation
- 208/240V~(ac) operation
- 277V~(ac) operation
- 380V~(ac) operation
- 415V~(ac) operation
- 480V~(ac) operation

Solid State Relay Control
- Single phase, single SSR
- Three phase, two leg control for three wire (non-grounded load), dual SSR.
- Resistive load only

Inputs
- Solid state contactor, AC input (**CA**)
  ON, 90 to 240V~(ac); OFF, 0 to 10V~(ac)
- Solid state contactor, DC input (**CD**)
  ON, 3 to 32VDC; OFF, 0VDC
- Burst firing (zero cross) control card (**BL**)
  Input 4 to 20mA only
  Bias and Gain adjustable
  Input impedance 500 minimum
- Burst firing (zero cross) control card (**BT**), 1Ø only
  Input factory adjusted for 4-20mA
  Bias and Gain adjustable, 0 to 12VDC/0 to 25mA
  Input impedance 300 (clip R-22 for 5K , voltage input)
- Phase angle control card (**AT+**), 1Ø only
  Input factory adjusted for 4-20mA
  Bias and Gain adjustable, 0 to 12VDC/0 to 25mA
  Input impedance 300 (clip R-2 for 5K , voltage input)
  Soft start 10 seconds (approx.)
- 120/240V~(ac) or 480V~(ac) to 24V~(ac) power transformer included, model dependent for AT+ and BT options.

Outputs
- 120V~(ac) through 480V~(ac)
- 10-75A

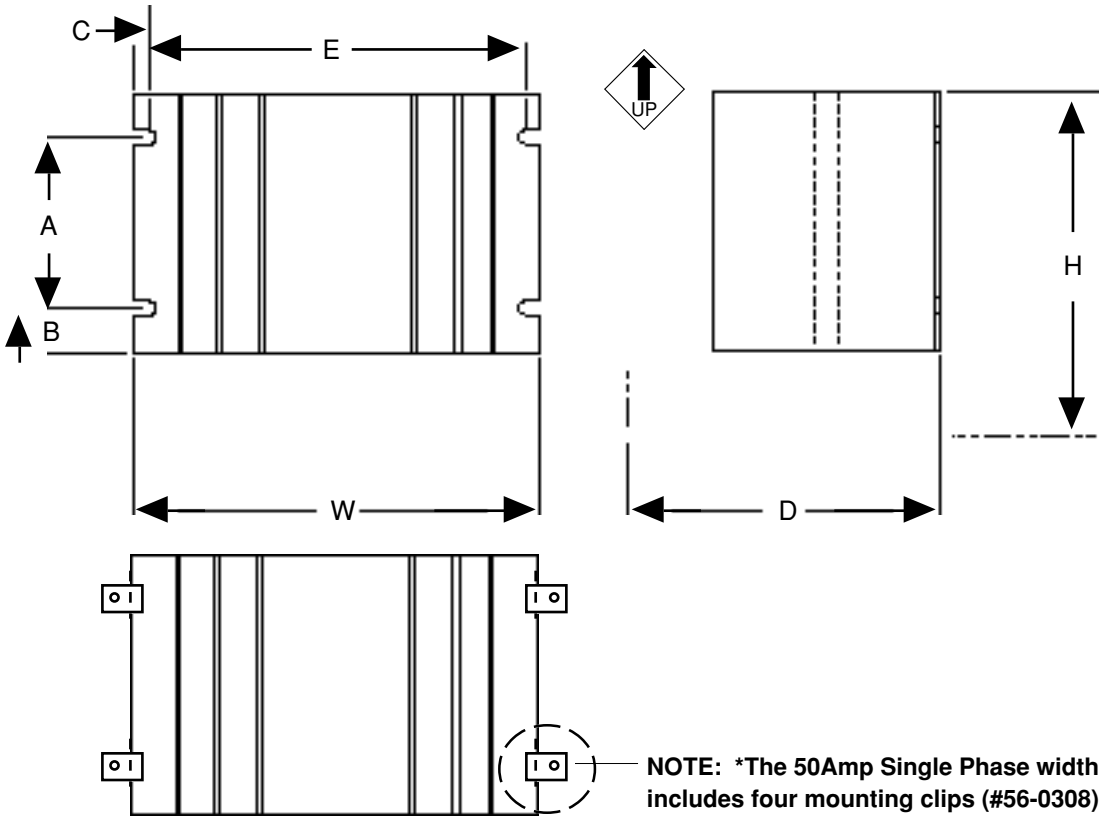
Operating Ambient
- Temperature - 0 to 50°C
- RH - 0 to 90%, non-condensing

Specification subject to change without notice.

Returns

1. Call Customer Service, 507-454-5300, for a Return Material Authorization (RMA) number before returning any item for repair. We need:
   - Ship to address
   - Bill to address
   - Contact name
   - Phone number
   - Ship via
   - Your P.O. #
   - Symptoms and/or special instructions
   - Name & phone of person returning the material.
2. Prior approval and an RMA number, from the Customer Service Department, is needed when returning any unused product for credit. Make sure the RMA number is on the outside of the carton, and on all paperwork returned. Ship Freight Prepaid.
3. In cases of manufacturing defect, we will enter a repair order, replacement order, or issue credit for material. A 25% restocking charge is applied for all returned stock controls and accessories.
4. If the unit is unrepairable, it will be returned to you with a letter of explanation. Repair costs will not exceed 50% of the original cost.

VPAC Dimensions and Mounting



WARNING:

VPAC mounting and spacing must conform to local, state and national safety codes. Failure to conform to codes could result in death or personal injury, or damage to equipment.

CAUTION:

Mount units with heat sink fins oriented vertically. Failure to do so could result in unit failure and damage to the process.

NOTE: *The 50Amp Single Phase width mounting dimension includes four mounting clips (#56-0308) instead of the 1/2 round cutouts.

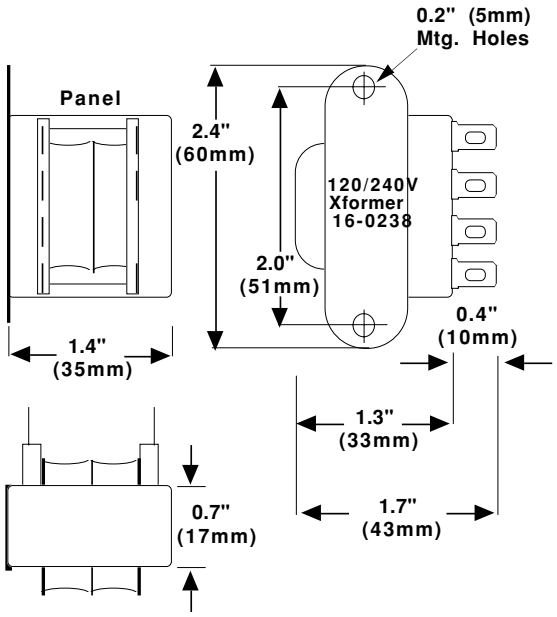
NOTE: 3-Phase, 2-Leg 10-40A use 2 heat sinks for overall dimensions.

NOTE: Mounting dimensions show maximum possible height and depth with terminal-mounted control card attached. Unit height and depth varies with control card configuration.

Maximum Overall Dimensions				Mounting Dimensions				
V01 10-40A								
Amps	**Height (H)**	**Width (W)**	**Depth (D)**	**A**	**B**	**C**	**E**	**Fan Cooled**
10	5.60"	4.50"	1.50"	3.00"	0.50"	0.15"	4.20"	No
25	5.50"	4.75"	3.60"	2.00"	0.50"	0.15"	4.45"	No
40	6.30"	4.75"	3.60"	4.50"	0.50"	0.15"	4.45"	No
V32 10-40A								
Amps	**Height (H)**	**Width (W)**	**Depth (D)**	**A**	**B**	**C**	**E**	**Fan Cooled**
10	5.60"	9.00"	1.50"	3.00"	0.50"	0.15"	4.20"	No
25	5.50"	9.50"	3.60"	2.00"	0.50"	0.15"	4.45"	No
40	6.30"	9.50"	3.60"	4.50"	0.50"	0.15"	4.45"	No
V01 50-75A								
Amps	**Height (H)**	**Width (W)**	**Depth (D)**	**A**	**B**	**C**	**E**	**Fan Cooled**
50A	9.00"	*6.90"	3.50"	7.00"	N/A	N/A	5.90"	No
75A	10.50"	5.00"	5.50"	7.00"	1.00"	0.15"	4.70"	Yes
V32 50-75A								
Amps	**Height (H)**	**Width (W)**	**Depth (D)**	**A**	**B**	**C**	**E**	**Fan Cooled**
50A	10.50"	5.00"	5.50"	7.00"	1.00"	0.15"	4.70"	Yes
75A	10.50"	5.00"	5.50"	7.00"	1.00"	0.15"	4.70"	Yes

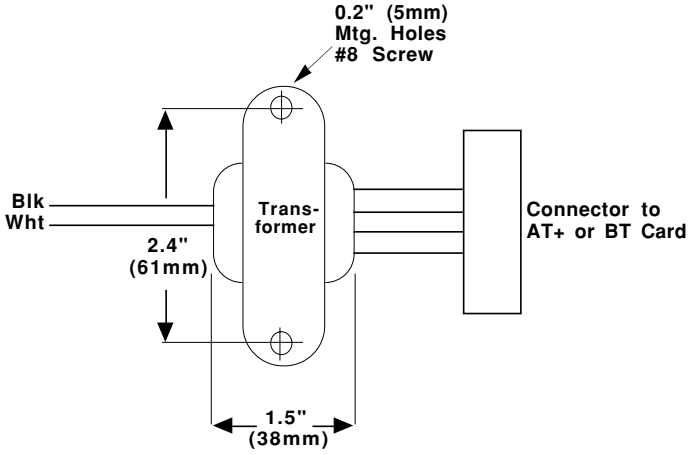
Mount 120/240V Transformer AT+/BT Power

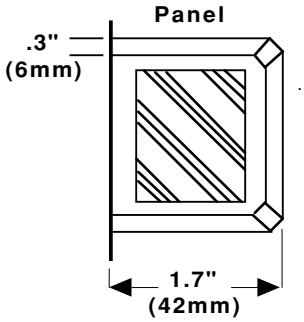
The AT+ or BT transformer powers the AT+ or BT control card. Mount the transformer within 12 in. (30.5cm) of the VPAC it connects to.



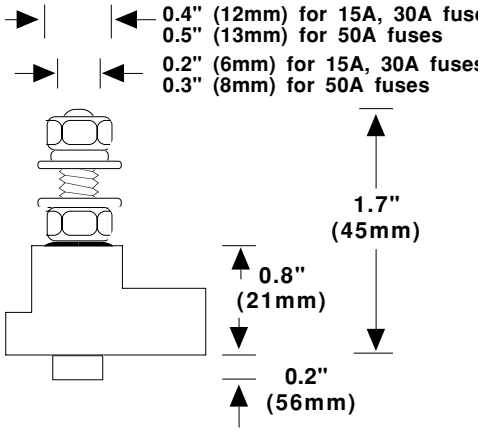
Mount 277 to 480V Transformers AT+/BT Power

The AT+ or BT transformer powers the AT+ or BT control card. Mount the transformer within 12 in. (30.5cm) of the VPAC it connects to.

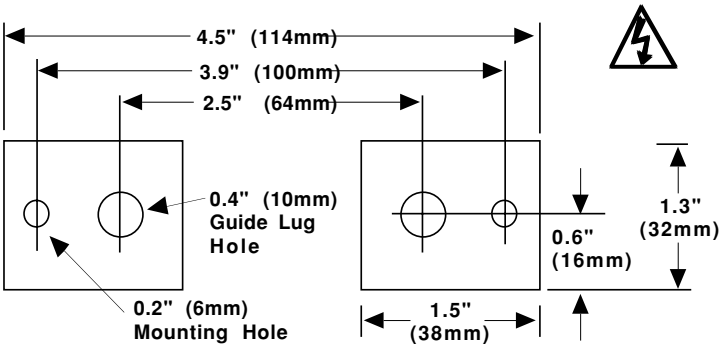




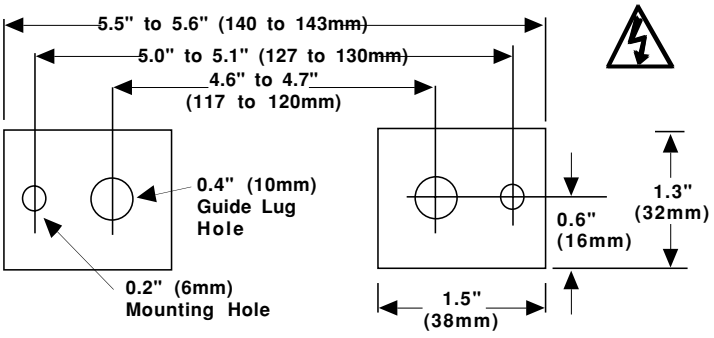
Mount Semiconductor Fuses



Mount 15/30A Semiconductor Fuse



Mount 50/100A Semiconductor Fuse



Mount Semiconductor Fuses

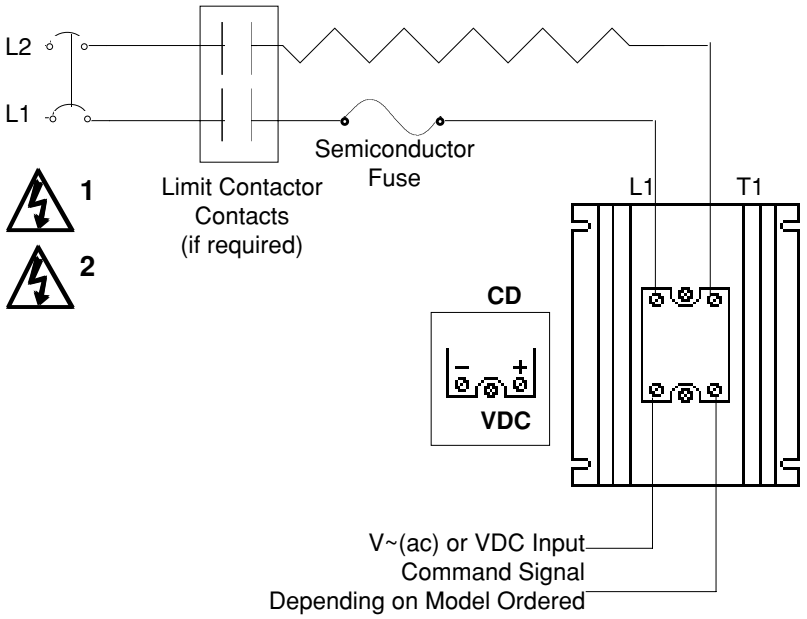
Mount optional semiconductor fuses near the VPAC. Mounting must conform to code requirements. Wiring diagrams show proper connections.

WARNING:

Fuse mounting and spacing must conform to local, state and national safety codes. Failure to conform to codes could result in damage to equipment and/or injury to personnel.

Single Phase Wiring

1Ø Wiring for AC & DC Input Contactor 10-40A, Models (CA or CD)



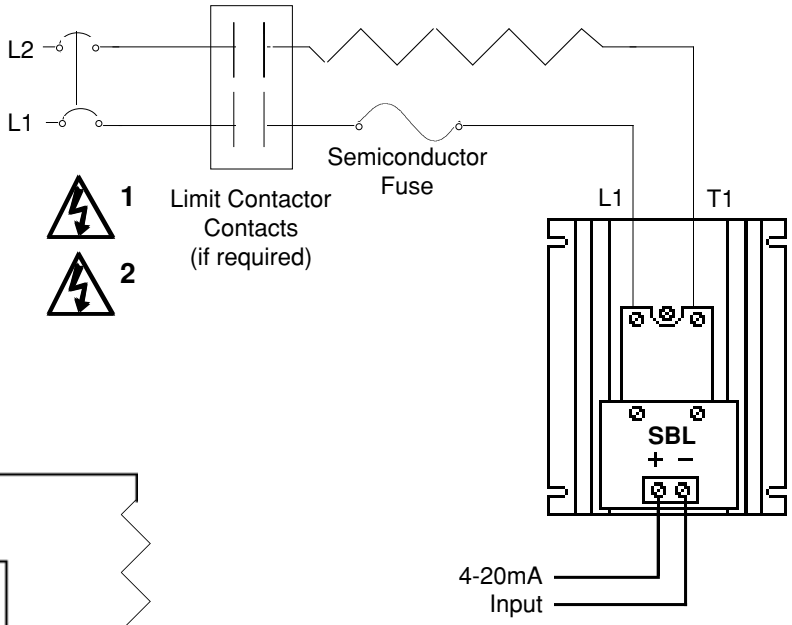
WARNING: 1

Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in death or personal injury.

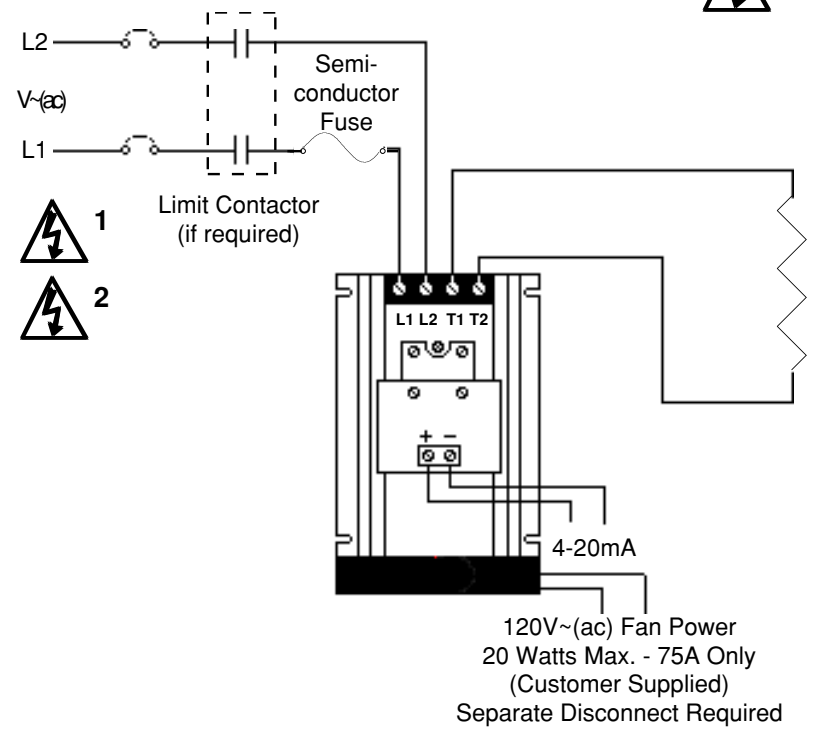
WARNING 2

Wiring examples show L2 in 240V~(ac) or 480 V~(ac) configuration. In 120V~(ac) applications, L2 is neutral and must not be fused or switched. Failure to follow this guideline could result in death or personal injury.

1Ø Wiring, 4-20mA Burst, 10-40A (BL)

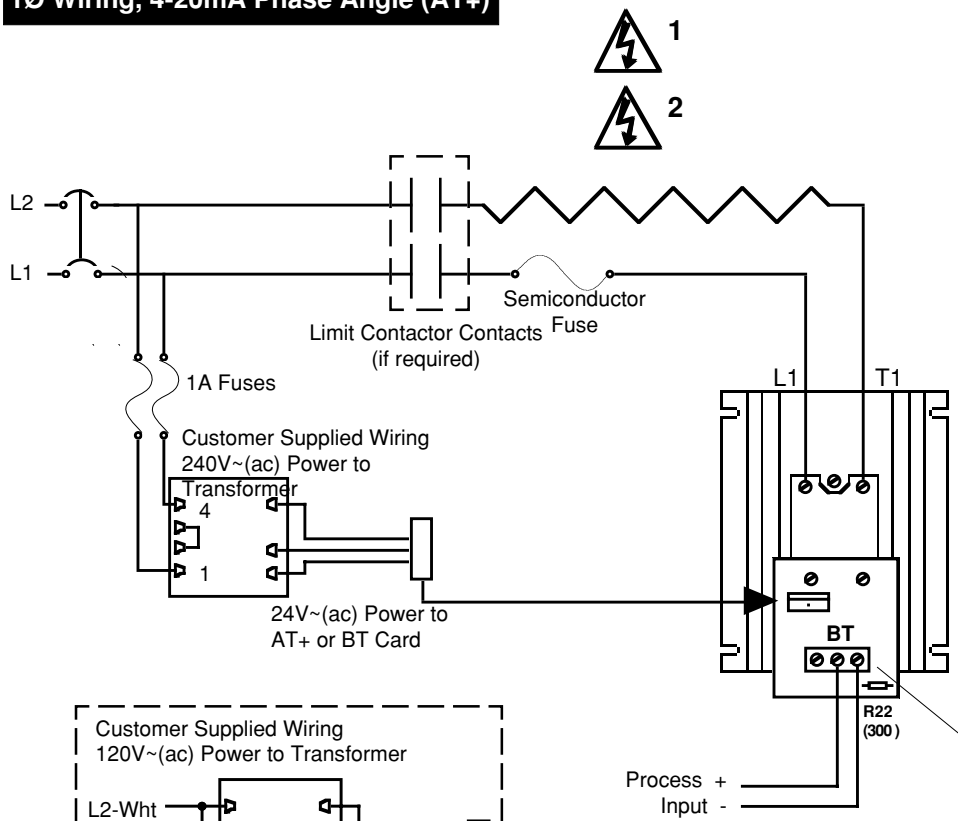


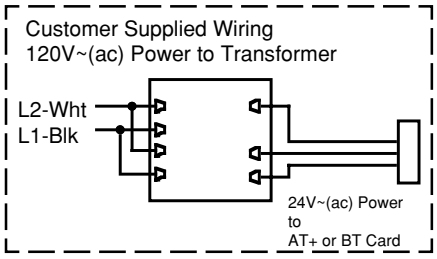
1Ø Wiring, 4-20mA Burst, 50 & 75A (BL)

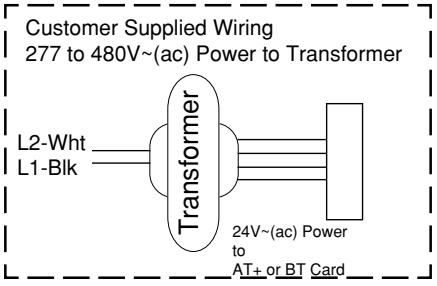


Single Phase Wiring

1Ø Wiring, 4-20mA Burst (BT)
1Ø Wiring, 4-20mA Phase Angle (AT+)







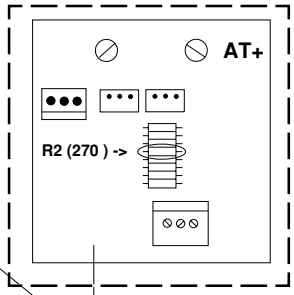
NOTE: The control transformer must be on the same phase as the load. See wiring diagram above. All hot lines to the transformer should be fused at 1 Amp with the proper line voltage.

WARNING: 1

Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in death or personal injury, or damage to equipment.

WARNING: 2

Wiring examples show L2 in 240V~(ac) or 480 V~(ac) configuration. In 120V~(ac) applications, L2 is neutral and must not be fused or switched. Failure to follow this guideline could result in death or personal injury.

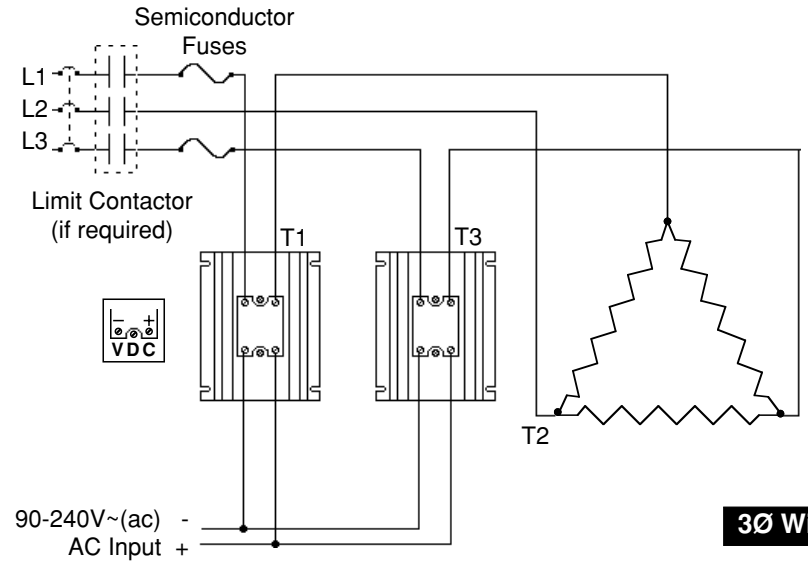


NOTE: For manual control, a 1K potentiometer may be connected to the BT or AT+ card input terminals. Watlow offers a kit as Manual Control Kit, part number, 08-5362. Using this potentiometer requires removing the specified control card resistor for higher impedance.

Bias and gain adjustment is required when changing from 4-20mA input to a manual control input or a voltage input.

3-Phase, 2-Leg Wiring

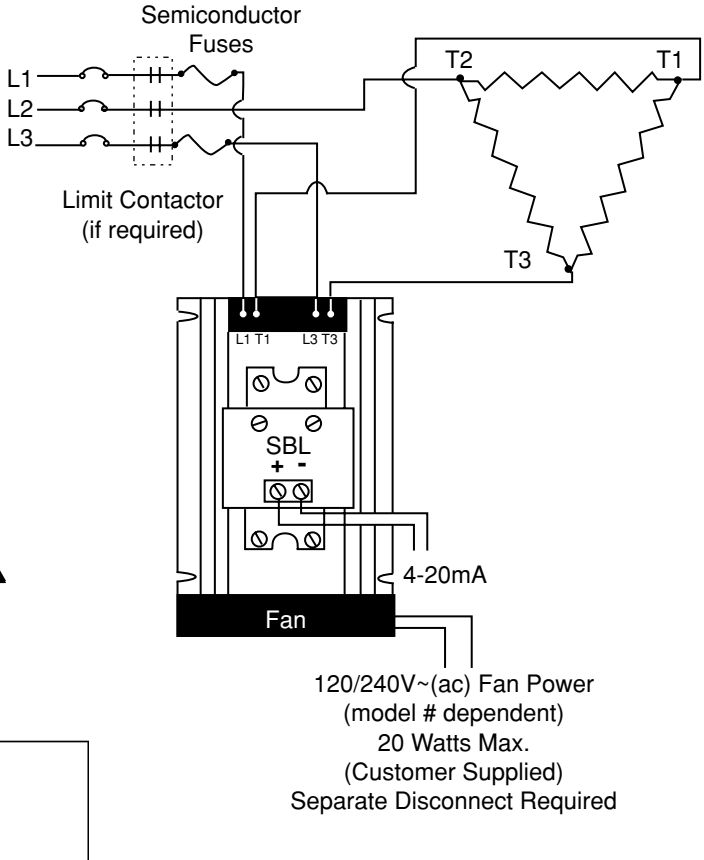
3Ø Wiring for AC & DC Input Contactor 10-40A, Models (CA or CD)



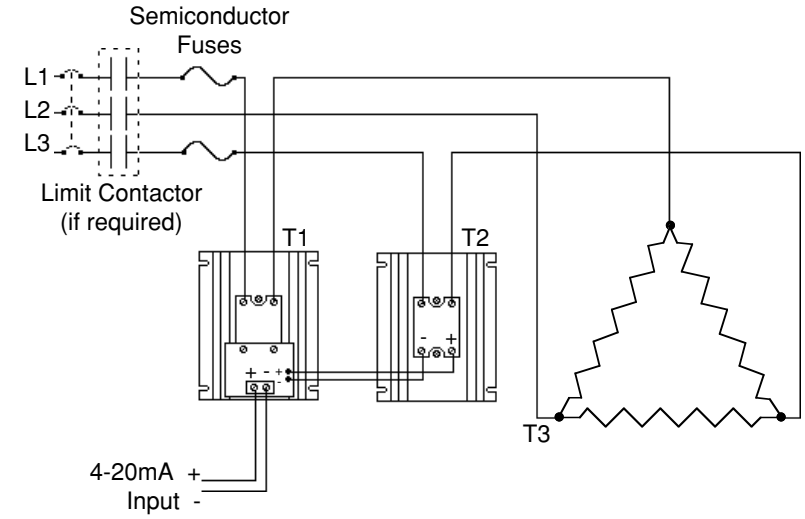
WARNING:

Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in death or personal injury, or damage to equipment.

3Ø Wiring, DC Contactor, 50 & 75 A (BL) (CD)



3Ø Wiring, Burst Fired, 4-20mA, 10-40 A (BL)



Troubleshooting

To isolate a system problem involving the VPAC, answer these questions:

- Are inputs to the VPAC present?
- Are outputs from the VPAC present?
- Are all connections good?
- Is the load good?
- Is line voltage within specification?
- Are temperature control signals present? If so, then the VPAC power control itself may be the problem. The problem may be with the VPAC's control card, transformer or solid state relay. Use the table below to assist with troubleshooting.

Symptom	Probable Cause	Corrective Action
No output	Fuses blown	Check and replace fuses.
	Incorrect input wiring	Verify input wiring.
	Incorrect input signal	Check temp. control output.
	Input signal reversed	Verify input wiring.
	Input signal not adjusted	"See Bias and Gain Adjustment."
	Wrong or missing control card	Verify input wiring. Check transformer connections.
	Missing load wiring	Verify load wiring The SSR(s) will not function without a load.
Transformer hot	Incorrect transformer	Check product & transformer labels (AT+ & BT only).
Uncontrolled output full ON	Bad control card, or Bias and Gain out of adjustment	Disconnect control card, try again. If no output, SSR is okay. Check Bias and Gain Adjustment.
	Bad transformer	Unplug transformer wires and try again. (AT+ & BT only.)
	Bad SSR	If full ON or half ON output present with no control card and no transformer, solid state relay is bad; replace it.

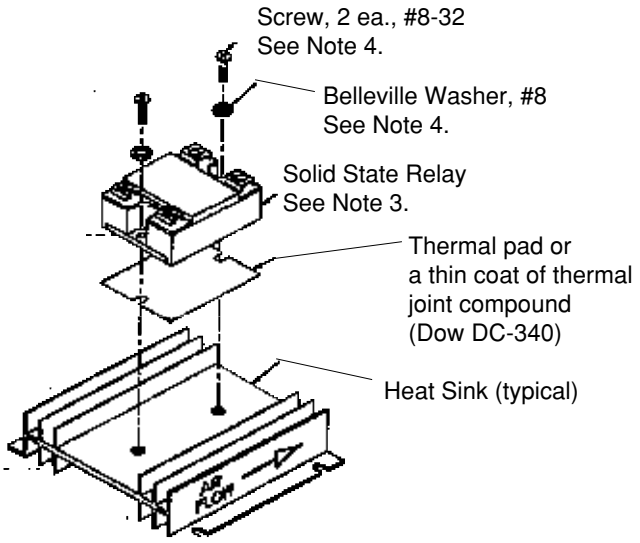
Bias And Gain Adjustments

The VPAC bias and gain can be adjusted for the output of most standard, proportional output temperature controls. Bias and gain is factory set for an input control signal (0-5VDC or 4-20mA), but may require minor adjustments to match the output of a specific temperature control.

We recommend that bias and gain adjustment be performed using a dummy load. In some applications, a dummy load may be required if the controlled load can not be turned full ON. A dummy load can be easily made by connecting 150 watt lamps in series to match the operating voltage of the VPAC. Use the following steps to make adjustments.

1. Connect an AC voltmeter across the load or dummy load of the VPAC. Connect a DC voltmeter across, or milliampmeter in series with, the input signal from the temperature controller.
2. Apply power to the system.
3. Set the output signal of the temperature controller to zero or its minimum output. Adjust the bias potentiometer slowly until the VPAC output just comes ON. Then turn it in the opposite direction until the output is just full OFF as observed on the output voltmeter.
4. Adjust the output of the temperature controller to full ON (5VDC, 20mA, etc.). Adjust the gain potentiometer until the VPAC output is just full ON.
5. Repeat Steps 3 and 4 until the VPAC turns full ON with a full ON signal from the temperature control, and full OFF with the minimum input signal from the temperature control. Steps 3 and 4 may need to be repeated a few times (an adjustment made on one of the potentiometers affects the adjustment of the other potentiometer).
6. Remove power, disconnect the meters, and reconnect the controlled load to the VPAC if required.

Replace SSR



1. Surface must be clean and flat.
2. Use a thermal pad or a thin coat of thermal joint compound (Dow DC-340 or equivalent).
3. Mount the SSR to the heat sink.
4. Use Belleville (spring) washers and tighten screws alternately until the spring is deflected slightly.

CAUTION:

Heat sink must be mounted so that the fins are vertically aligned.

CAUTION:

Heat sensitive component; ambient temperature must not exceed 122°F (50°C). If overheated, unit could fail.

CAUTION:

Heat sensitive component; do not mount SSRs on panels that are painted, plastic, steel or stainless steel. These materials will not remove heat generated by the SSR. If overheated, unit could fail.

Feedback

Your comments and suggestions on this manual are welcome. Please send them to: Technical Writer, Watlow Controls, P.O. Box 5580, Winona, MN 55987-5580, or call (507) 454-5300 or fax (507) 45204507. The VPAC Users Manual is copyrighted by Watlow Winona, Inc., © December 1999, with all rights reserved. (1820)